# HART TRANSMITTER DEVICE WITH A SINGLE MICROCONTROLLER
(9600/1200 bps HART-DS™ Modem + HART® 7.0 Stack)

Smart Embedded Systems (SES) , Inc. Silicon Valley, California Company is the first company to offer dual speed (9600 and 1200 bps) modem and HART Stack in a single microcontroller and this solution is based on the FieldComm group standards for C8PSK specifications. Since the modem functionality is implemented with the firmware, there is no need for an external chip modem. This makes the SES solution for the HART device to be cost effective, more reliable, requiring less PCB and also the design complies with the power requirements outlined by the standards of FieldComm Group.

OUR SOLUTION:
System on a chip (SoC) Based 9600/1200 BPS (C8PSK/FSK)MODEM + HART 7.0 Stack :
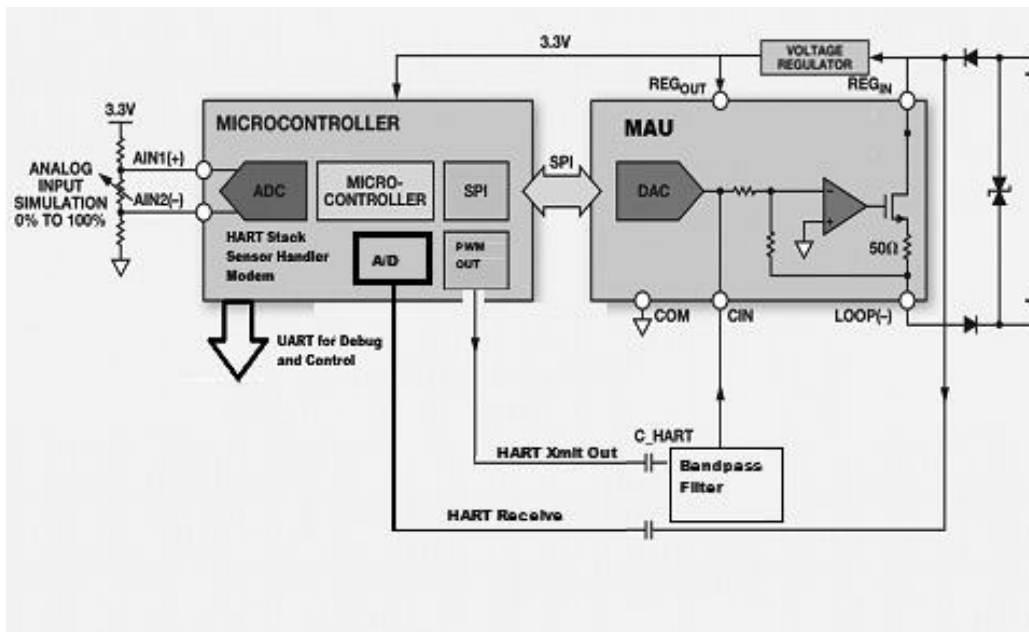
Our 9600/1200 BPS modem is firmware based; implemented with Texas Instruments (TI) MS430 microcontroller. Besides modem functionality, we also offer the following on the same microcontroller:

Soft modem
Benefits
- Lower cost
- Lower power 400 uA FSK mode and 900 uA 9600 bps (C8PSK mode) at VCC of 2.7V
- Works with any third party HART stack
- Increased throughput
- Low power table lookup based modulator using SES patented methods
- Smart Phase and Timing detection of incoming signals using SES patented methods
- High reliability
- Flexibility and field upgradable with these options:
    - a. C8PSK & FSK modes
    - b. FSK mode; upgrade to C8PSK and FSK modes
    - c. FSK mode only
- Smaller footprint

SES HART STACK 7.0
Specific Features
- Smart Publishing
- Event Notification
- Report by exception
- Time stamping
- Long Tag Support
- Expanded Manufacturer ID

System on a Chip (SOC) based solution
- Uses off the shelf microcontroller
- Uses low voltage FRAM based microcontroller
- HART 7.0 and soft modem run on the same microcontroller
- Sensor Interface
- Capability to add AES encryption

HART (C8PSK) 9600 Modem Characteristics

Coherent 8 Phase Shift Keying
Bits per symbol : 3 bits
8 Symbols per HART C8PSK Specifications

Carrier Frequency : 3200Hz. ±1%
Data Rate : 9600 Bits Per Second ±1%
Supports Normal Analog Wiring

HART FSK Modem Characteristics

Binary Frequency Shift Keying
Bits per symbol : 1
Mark = 1200Hz; Space = 2200Hz ±1%

Carrier Frequency : 1700Hz.
Data Rate : 1200 Bits Per Second ±1%
Supports Normal Analog Wiring

Modulator Characteristics

Carrier Startup : Less than 3 symbols
Carrier Stop : Less than 3 symbols

Demodulator Characteristics

Receive Equalizer : Fractional Adaptive, Learning
Carrier detect Threshold : Programmable
Dynamic Range : 15 dB minimum
(150mV – 900mV)
PSK Assertion : Less than 10ms
C8PSK to FSK : automatic
Receive Filtering for Analog signal Interference rejection: 20 dB minimum

RX Signal CD On : 80mV - 120mV
CD On time : 1ms - 4ms
CD off time : 5ms - 10ms
Rx Signal Level : 120mV - 1000mV

Applications:

A. Process control and factory automation
B. Temperature sensors
C. Flow transmitters
D. Level transmitters
E. Pressure transmitters

Board Support Package for Evaluation includes:

A. Board
B. Schematic
C. BOM (Bill Of Materials)
D. HART Stack Binary code
E. SOFT Modem Binary code

SES has been awarded four patents related to its soft modem technology for HART devices: 9106488, 9184965, 9203665, 9281978 and additional patents pending.

Modem and/or
Stack circuitry
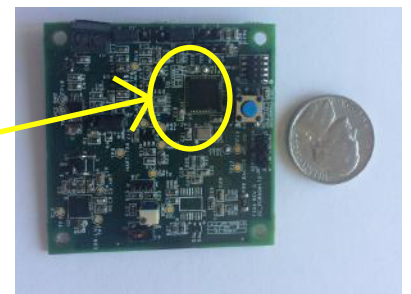
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